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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the air-blow-system aerator which performs separation with suspended solids, such as floating sludge, and water with a membrane module.

[0002]

[Description of the Prior Art] When processing the sanitary sewage with an activated sludge process, it sets to the former. Within an aerator (microorganism reaction vessel) Adsorption / metabolic turnover decomposition is carried out by the anaerobic microorganism. the organic substance in the sanitary sewage -- aerobic bacteria or a denominator -- While decreasing the disease germ, aerobic bacteria etc. were proliferated, and further, this microorganism growth liquid was transported to precipitate / separation tub, precipitate separated into supernatant liquor and microbial population, i.e., sludge, and while discharging supernatant liquor as treated water, some precipitate sludge is returned to the aerator. However, in this approach, a precipitate separation rate is slow and processing speed is a low speed.

[0003] then, in these people, it replaced with the above-mentioned precipitate separation, separation by the membrane module be considered, and "the air blow system aerator characterize by establish the means for arrange in right above [of said diffuser] the film equipment which have a diffuser and have the direction path of a vertical along with a film surface, and make the membrane transparency side of this film equipment into negative pressure" be already proposed (JP,4-70958,B).

[0004] In this air-blow-system aerator, since the differential pressure between film required for membrane separation has been obtained by making the transparency side of a membrane module into negative pressure, it is not necessary to pressurize an undiluted solution (sanitary sewage), the conventional aerator can be used as it is, and turning of the sanitary sewage by aeration can also be performed good under the ordinary pressure of the sanitary sewage. It can **, a vapor-liquid interflow object can be made to be able to flow at high speed along with a film surface, the sludge adhesion by the film surface can be controlled, membranous transparency flux can be highly maintained over a long period of time, and solid liquid separation can be performed at high speed.

[0005]

[Problem(s) to be Solved by the Invention] By the way, according to this invention person's etc. experimental result, although it changes with a sanitary-sewage flow rate, the concentration of the organic substance in the sanitary sewage, membranous transparency flux, etc., it is usually appropriate for the film surface product of a membrane module to consider as 7-10m²/m³ per effective unit volume of an aerator.

[0006] In the above-mentioned air-blow-system aerator which these people proposed to **** to a membrane module Insert permeate liquid passage material between double-sided film, and permeate liquid catchment tubing is attached in the width ends of the laminated material. When using the module which installs two or more film units which closed the vertical edge of this laminated material with adhesives, assembles permeate liquid catchment tubing as a structural member, and changes, the film surface product per film unit 2m also as 2 Usually, it is necessary to use the film unit of dozens of

sheets, and, in the case of the aerator of the volume, the activity of the assembly structure whose die length is several m also as 0.1m is obliged to the sanitary-sewage path gap between film units.

[0007] This membrane module needs to pull up on a tub periodically because of inspection and maintenance. Since permeate liquid passage is covered with permeated water at the permeate liquid catchment tubing list of a film unit and sludge has also adhered to the membrane module at the time of this pickup, in order to become pickup of the large-scale assembly structure of high weight and to prevent deformation by the self-weight of this structure, it is necessary to combine strongly between permeate liquid catchment tubing which is structural members.

[0008] Moreover, the turning rate of flow of a vapor-liquid interflow object needs to be accelerated, and it is necessary to receive the sanitary-sewage fluid pressure which benefits that large-sized structure size in a membrane module in this case that a microorganism rate of reaction should be accelerated with improvement in the speed of the solid liquid separation by the membrane module, and to combine strongly between permeate liquid catchment tubing which is structural members also for deformation prevention of the structure concerned to this pressure.

[0009] However, in having combined strongly between permeate liquid catchment tubing of a film unit, exchange of a film unit becomes difficult. On the other hand, if it is simple geometry so that a film unit can be exchanged easily, we will be hard to prevent deformation of the membrane module under improvement in the speed of the swing speed of the time of pickup of a membrane module or a vapor-liquid interflow object, and will be anxious about membranous hauling fracture.

[0010] The object of this invention is immersed in an air-blow-system aerator in the membrane module which installed the plate-like film unit in two or more sheets and the vertical condition. When make the transparency side of a film unit into negative pressure, a solid-liquid-separation rate is made quick, the swing speed of a vapor-liquid interflow object is made into a high speed and microorganism processing speed of the organic substance is made quick, It is in offering the air-blow-system aerator for which the film can be safely held also under pickup for maintenance and inspection of a membrane module, and the high speed of a vapor-liquid interflow object rate, and a film unit can be exchanged easily.

[0011]

[Means for Solving the Problem] The air-blow-system aerator of this invention makes permeate liquid catchment tubing almost vertical for two or more [of the film unit which attached permeate liquid catchment tubing between double-sided film at least at one side of the ends of a film member which has permeate liquid passage] into a frame. And separate and arrange predetermined spacing between film units, and immersion installation of the membrane module which comes to attach permeate liquid catchment tubing of these film units free [the attachment and detachment to a frame] is carried out into the aerator which has a diffuser. It is the configuration characterized by having connected permeate liquid catchment tubing of each film unit to permeate liquid drawing piping, and forming a reduced pressure means in this piping, and it is desirable to use what has a face-plate parallel to a film unit for a frame.

[0012]

[Function] If a frame is made to pay all the reinforcement needed for a membrane module, it can be managed even if it does not use permeate liquid catchment tubing of a film unit as a dynamic member of the membrane module structure, and a plug method can perform simply anchoring to the frame of this permeate liquid catchment tubing, and it will become possible to exchange a film unit easily.

[0013] Moreover, since the frame is strong, deformation of the membrane module to improvement in the speed of the time of pickup of the membrane module from an aerator or a vapor-liquid interflow object swing speed can be prevented, and the film can be held safely.

[0014]

[Example] Hereafter, the example of this invention is explained, referring to a drawing. The flat-surface explanatory view of membrane module A which uses (b) of drawing 1 in this invention, and (b) of drawing 1 are the Law RO cross-section explanatory views in (b) of drawing 1 . As 1 shown a film unit and it shown in it in the [(Ha) Ha-Ha sectional view in (b) of drawing 2] of drawing 2 in (**) and (**) of drawing 1 at (**) of drawing 2 , and the (**) [Law RO sectional view in (**) of drawing 2] list of

drawing 2 Between a flat film 11 and 11 (on fiber supporting material, such as a nonwoven fabric or textile fabrics, film production liquid is applied and solidified and the film is formed), the permeate liquid passage material 12 (For example, a plastic net) is inserted, the permeate liquid catchment tubing 13 (usually product made from plastics) is attached in width ends, the lengthwise direction up soffit section is closed with adhesives 14, and the stop section 131 is formed in film pinching opening of the permeate liquid catchment tubing 13.

[0015] In (**) of drawing 1, and (**) of drawing 1, as a frame is shown and it is shown in drawing 3, 2 has the dovetail groove 21 for a stop whose inner surface carries out phase opposite in the second page, and has made it the immovable high heavy lift to the high-speed turning style of the vapor-liquid interflow object in an aerator (for example, product made from stainless steel). 22 is the leg, and in order to secure sanitary-sewage passage between membrane module A and an aerator base, it is made into height of 10cm - 20cm.

[0016] In (b), in the dovetail grooves 21 and 21 for a stop as for which the above-mentioned frame inner surface carries out phase opposite in the (b) list of drawing 1 While inserting vertically both the permeate liquid catchment tubing 13 and 13 of each film unit 1, the stop section 131 of the permeate liquid catchment tubing 13 is fitted loosely into dovetail groove opening, the film unit 1 is arranged at the predetermined spacing (usually about 10cm) in the frame 2, and the film unit 1 can be freely detached and attached to a frame 2.

[0017] Drawing 4 is the side-face explanatory view showing the air-blow-system aerator of this invention. In drawing 4, 3 is an aerator and is built by placing of concrete. A is the above-mentioned membrane module and is deferred on the base of an aerator 3 in the leg 22 of a frame 2, 41 and -- may be diffusers, such as a powder trachea arranged directly under membrane module A, and may always be any of aeration and intermittent aeration. Charging piping of as opposed to the powder trachea 41 and -- in 42 and 43 are blowers. 51 is the manifold which connected permeate liquid drawing piping and 52 to the vacuum pump, and connected 53 to the edge of the permeate liquid drawing piping 51, and has connected each branching opening of a manifold to each permeate liquid catchment tubing of a film unit group free [attachment and detachment].

[0018] In drawing 4, an arrow head B carries out adsorption / metabolic turnover decomposition of the organic substance in the sanitary sewage, the turning style of the vapor-liquid interflow object of the powder trachea 41, the blowout gas from --, and the sanitary sewage being shown, and an airborne microbe receiving gaseous supply, and while disease germs decrease in number, the microorganism is increased. Simultaneously, the transparency side of each film unit 1 of membrane module A is decompressed by actuation of a vacuum pump 52, and under the differential pressure between film by this reduced pressure, under washing of the film surface by the turning style, the water which is a solvent penetrates the film and is discharged from the permeate liquid drawing piping 51.

[0019] In the above, the swing speed of a vapor-liquid interflow object is made into the high speed of 1 m/sec - 2 m/sec, and the force it is weak to membrane module A size acts. However, the frame 2 of membrane module A is the rigid body, since a frame 2 does not deform, spacing between permeate liquid catchment tubing of each film unit 1 can be maintained with origin, and the film can be held safely.

[0020] Moreover, it is necessary to pull up membrane module A for membrane module A on an aerator periodically for maintenance and inspection (for pickup of this membrane module). Although membrane module A becomes Shigekazu Taka since the hook for hanging a wire on a frame was attached, and permeate liquid has collected in the film unit 1 at the time of a certain pickup of this and there is also adhesion of sludge Since a frame 2 is the rigid body, in spite of this Shigekazu Taka, it can pull up without bending and making membrane module A transform, deformation of the film unit 1 can be prevented, spacing between permeate liquid catchment tubing of each film unit 1 can be maintained with origin, and the film can be held safely.

[0021] By not being used as a dynamic member of the assembly structure of a membrane module, therefore inserting permeate liquid catchment tubing in a frame, with a method, permeate liquid catchment tubing of the above-mentioned film unit 1 can perform the exchange easily, even if it carries

out a film unit in the direction (perpendicular direction) which is fixable to a frame, it can bind the direction of a plug to the turning style of a vapor-liquid interflow object and exchange of a film unit is needed as a result of inspection.

[0022] In the above, the face-plates 2a and 2a parallel to the film unit 1 in a frame 2 are members very effective in making the force of having prevented the turning style of a vapor-liquid interflow object colliding with a film unit group from a longitudinal direction, and acting on membrane module A support with a frame 2 so that clearly also from drawing 4 . On the other hand, in both sides of the sense which separated the include angle of a right angle to these face-plates, as it is not necessary to necessarily constitute from a face-plate and is shown in drawing 5 , the upper and lower sides can be constructed across by the level connection member 231,232, the metallic ornaments 211 for inserting and binding permeate liquid catchment tubing of a film unit to the vertical member 231,232 of these and -- can be attached, and it can also consider as a release side.

[0023] Moreover, in the above-mentioned example, although permeate liquid catchment tubing is attached in the width ends of a film unit, it is also possible to attach permeate liquid catchment tubing only in one end, and to perform plug binding to the frame of a film unit with permeate liquid catchment tubing of the one end. In addition, the air-blow-system aerators of this invention are suspension other than the sanitary sewage, and also when processing the processed liquid which is easy to generate a gel layer especially to a film surface, ***** (ing) generation of the gel layer concerned by vapor-liquid interflow, they can be used.

[0024]

[Effect of the Invention] The air-blow-system aerator of this invention is a configuration as mentioned above, even if permeate liquid catchment tubing of a film unit is not used for it as a dynamic configuration member of a membrane module, it ends, can insert this permeate liquid catchment tubing in a frame, can bind it with a method, and can exchange a film unit easily. Moreover, by using a frame as the rigid body, also to the time of pickup of the high-speed turning style of a vapor-liquid interflow object, and a membrane module etc., deformation of a membrane module can be prevented and the film can be held safely.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the flat film module using the flat film element and this which used a cheap plate-like flat film and semipermeable membrane that it is suitable for separation of the liquid containing a suspended solid or sludge in more detail about the flat film module which used a flat film element and this, and especially a foreign matter cannot adhere easily.

[0002]

[Description of the Prior Art] Conventionally, a flat film element fixes a membranous (semipermeable membrane) circumference part to a filter plate by thermal melting arrival etc. all over the front flesh side of the porous filter plate which has reinforcement by plate-like. This flat film element is put on two or more sheet parallel, and the thing inserted in module housing of the shape of a rectangular parallelepiped which has a slot inside and opened only the upper and lower sides is marketed as a flat film module. JP,4-281828,A, JP,2-86893,A, JP,7-275668,A, and JP,6-178919,A are one of those proposed the same module configuration as these. Moreover, JP,5-137974,A, JP,6-178920,A, JP,6-226063,A, etc. are one of those proposed the flat film element. The approach of these mainly being used for the solid liquid separation of active sludge etc., being immersed in the interior of an activated sludge tank in a membrane module, attracting the interior of the film, and filtering is taken.

[0003] Moreover, the saccate membrane element which does not use a filter plate is also proposed. what carried out the seal of the membranous circumference, made the hole in part, and attached the output port of permeate liquid -- although -- it is. Moreover, these [two or more] are gathered and it is made the module by making output port open for free passage. For example, there are JP,2-293103,A, JP,7-31854,A, JP,7-308553,A, JP,8-155277,A, JP,8-323159,A, etc.

[0004] Furthermore, since a flat film element had the weak structure which catches a pressure when a pressure is applied from the interior, it had the fault which is easy to damage. When a pressure is applied from the interior of the film of these elements, in order to prevent membranous breakage, carrying out the seal of the film surface selectively is proposed by international disclosure JP,92,B / No. 09358, JP,7-31857,A, etc.

[0005] Moreover, the spiral mold membrane element which has arranged the raw water spacer so that raw water may flow in the shape of a straight line to the longitudinal direction of catchment tubing and parallel is proposed by JP,9-299770,A using the thing of the shape of a network cheap as a raw water spacer.

[0006]

[Problem(s) to be Solved by the Invention] However, the module which carries out the seal of the film to a filter plate has the trouble that an element becomes heavy while an element becomes [a filter plate] large at an expensive price, since the film is mostly attached to the whole filter plate. Moreover, although the film rocks by the flow of an undiluted solution and it is hard coming to carry out adhesion of sludge when not using a filter plate Since the reinforcement of the surrounding film part of the output port of the permeate liquid of an element runs short, depending on the flow of liquid While there is a

trouble of becoming easy to damage, when collecting two or more sheets and making it a module, there is a trouble that the structure which fixes an element becomes complicated and cost becomes high as a result. Moreover, about the seal of a film surface which prevents breakage with the pressure from the interior of membranous, it is not concrete and utilization has the trouble of not being easy. Then, these problems are solved, breakage of an element etc. does not take place, but reinforcement can fully hold, and a cheap element is made, and structure also aims immobilization of the element to a module at obtaining an easy and cheap module further.

[0007]

[Means for Solving the Problem] Then, artificers found out that it considers as the support plate structure which supports the flat film part which has flexibility, and this flat film part, and various structures of a flexible flat film part were examined, various modular structures were examined further, and the above-mentioned problem could be solved, as a result of examining a flat film element, the configuration of a flat film module, a member, and structure in view of such a situation.

[0008] Namely, the saccate quadrilateral plate-like film with which the flat film element of this invention was flexible with film, the flat film was prepared in the whole surface along both sides of the permeate liquid passage material which lets permeate liquid pass, and three sides of peripheries were closed, The film supporter material which has said permeate liquid passage member and a **** path open for free passage while being attached along one side of peripheries which are not closed [of this plate-like film], covering the part on a both-sides front face, respectively and carrying out junction support at the edge of two sheets of said flat film, It is characterized by having the nozzle which opens thickness for free passage with the **** path of film supporter material rather than film supporter material to the ends of this film supporter material at least at one side of the head formed thickly and this head, and takes out permeate liquid. moreover, one or more places which make one side and parallel of the plate-like film which prepared film supporter material in the plate-like film -- a line -- it is characterized by preparing the seal section selectively. Moreover, it is characterized by putting the plate-like film side by side to two or more sheet serial at the longitudinal direction of film supporter material. Moreover, it is right-angled to one side of the plate-like film which prepared film supporter material in the plate-like film, and is characterized by preparing one or more slits extended from the side of the opposite hand of this side.

[0009] Moreover, it is characterized by for the flat film module of this invention having accumulated the head for two or more sheets of the flat film element of this invention on parallel in contact with mutual, having formed space between film supporter material, and liquid equipping with it the frame of the shape of a rectangular parallelepiped which can go in and out freely in the six directions.

[0010] Moreover, the entrance of liquid which the flat film module of this invention is a flat film module which consists of a box of the shape of a rectangular parallelepiped which equipped the interior with two or more sheets of the flat film element of this invention, and was established in the field of the upper and lower sides of said box, respectively, The output port of the permeate liquid which it is prepared in any first page of said box, and is connected with the nozzle of said flat film element, It is prepared in the side face of a box, has the aperture which can take a flat film element, and is characterized by equipping in support of a part of flat film element only in respect of either of the boxes. Moreover, wearing of a flat film element is characterized by supporting a head by the crosspiece. Moreover, it is characterized by preparing a gaseous feed hopper in the underside of a box.

[0011] Moreover, the flat film module of the spiral mold of this invention It is flexible and the flat film of a quadrilateral is prepared in the whole surface along both sides of the permeate liquid passage material which lets permeate liquid pass. It considers as the saccate stick-shape plate-like film which divided to two or more slits prolonged [to / from the edge by the side of one side / near the other end by the side of the side which opposes] in a lengthwise direction, and closed the periphery. The liquid collecting tube which was open for free passage to the terminal of the longitudinal direction of this stick-shape plate-like film at permeate liquid passage material is formed. Centering on this liquid collecting tube, a corrugated spacer is rolled about in the shape of a spiral in piles on said other end of the stick-shape plate-like film, the stick-shape plate-like film is contained in a cylindrical case, and it is

characterized by establishing the inlet port and outlet of a processed liquid in the ends of said case, respectively.

[0012]

[Embodiment of the Invention] By doubling and having the flexible film section which can be manufactured cheaply that sludge makes it hard to adhere, and a supporter with reinforcement in an element by having the shape of a square which has the outline neighborhood, using this one side as a supporter, and making the remainder into the comparatively flexible film section, the flat film element of this invention is cheap, and can be made into the structure where reinforcement can be held.

[0013] As long as it can pass permeate liquid, what kind of thing may be used for the flexible permeate liquid passage material used for this invention. For example, mesh-like textiles, a nonwoven fabric, the felt, a porosity member, etc. are mentioned. Among these, there is little configuration change by the pressure and mesh-like textiles fit this invention. As long as the diameter of opening of a mesh is the size which can pass a liquid, what kind of thing is sufficient as it. 200 meshes - one mesh of a mesh size is desirable, and they are 100 meshes - five meshes preferably. If it exceeds 200 meshes, the diameter of opening will become fine too much, and permeate liquid will stop being able to pass this easily.

Moreover, in less than one mesh, the diameter of opening becomes large too much, an eye is too coarse, and it is because it becomes or a life becomes short that a flat film is forced on a mesh when a pressure is applied, and it is easy to cause breakage. Such two or more mesh may be used in piles, and the fine mesh of extent which does not hurt a flat film, the coarse mesh which liquid tends to pass may be compounded and used for them, and it may be used for them, compounding with things other than a mesh. Moreover, although what kind of thickness is sufficient as the thickness of permeate liquid passage material as long as the failure of pressure has little permeate liquid and it can pass, it is 0.5mm - about 3mm preferably. It is because a film part becomes thick too much, and flexibility will be spoiled, pressure loss when permeate liquid flows in less than 0.5mm will become large and it will become an energy loss, if it exceeds 3mm.

[0014] It is joined to the edge of one side of the plate-like film, and the film supporter material of this invention is supporting the plate-like film. As long as a configuration is the gestalt which can support said one-side part, what kind of thing is sufficient as it. For example, the thing of the shape of plate-like or a pipe is raised. Especially, supporter material plate-like from the flat film of the plate-like film being thin film in this invention is desirable. Furthermore, the lap part of film supporter material and the edge of the plate-like film makes film supporter material an interior side, and the edge of a flat film covers the part on the outside front face of both film supporter material, and it laps and joins. Little way of lap width of face is desirable. However, since joining and adhesion are performed for junction at supporter material and the edge of the plate-like film, a certain amount of lap is required on reinforcement. The distance of a lap part has 0.5cm - about 10 desirablecm, and it is 1cm - 5cm preferably. It is not practical for bond strength to run short in less than 0.5cm, and to exceed 10cm.

[0015] Moreover, ***** which is open for free passage to permeate liquid passage material may be formed in the interior, and as long as film supporter material can be opened for free passage to permeate liquid passage material, ***** which consists of much micropores like a porous body is sufficient as it, and it may not have the opening passage which has one large opening. However, when the membranous penetrability force is large, the way where opening passage is formed in the interior has little resistance of flow, and is desirable. The thick head thicker than film supporter material is prepared in the both ends of the film supporter material of the flat film element of this invention. Moreover, the nozzle which takes out permeate liquid outside is prepared in one [at least] head. It can connect with the head of an adjacent flat film element with this head, or can fix to module housing. Therefore, dependability can support a flexible flat film element highly efficiently by the head and film supporter material. moreover, a head and film supporter material may be fabricated in one, and consist of separate members -- having -- **** -- adhesion, welding, etc. -- liquid -- seal fixing may be carried out densely.

[0016] Moreover, what kind of thing is sufficient as the construction material of film supporter material or a head, for example, all plastics, such as a polyvinyl chloride, polyethylene, polypropylene, AS and ABS, acrylic resin, polyolefine system resin, poly ape phone system resin, polyimide resin, and fluorine

radical content resin, can be used for it. Moreover, inorganic materials, such as stainless steel and a ceramic, can also be used.

[0017] Moreover, what kind of film is sufficient as the flat film of this invention. For example, the film could be applied to a nonwoven fabric, textile fabrics, and those front faces and interior, or impregnation could be carried out. Especially a nonwoven fabric is [among these] desirable. There is reinforcement and it is suitable for the operation of this invention. Moreover, membranous construction material may be semipermeable membrane and the raw material may be polyether sulphone, polysulfone, a polyacrylonitrile, a polyamide, polyimide, cellulose ester, etc. Moreover, membranous thickness has about 0.1-5 desirablemm. it is because membranous flexibility comes to run short, membranous reinforcement generally becomes weak in less than 0.1mm, it comes out and nonconformity is shown in it, when the membranous thickness of 5mm is exceeded here. Moreover, although polyester, nylon, polypropylene, polyethylene, the poly ape phone, etc. are illustrated as membranous construction material, polyester is common, and processing of adhesion etc. is easy to carry out and is desirable.

[0018] Moreover, in the flat film of this invention, the seal section which was made to stick the flat film of two sheets of the both sides of permeate liquid passage material, and carried out the seal in the film surface sections other than a periphery may be prepared. Especially the seal section is preparing the seal section in one side which prepared film supporter material, and parallel, and its reinforcement of a flat film element improves. That is, although a flat film tends to swell when a pressure is put from between the flat films of two sheets, the seal section which stuck this prevents and strength is strengthened. Moreover, although the whole film deforms and distortion is produced when a film surface swells since the film section of this invention is comparatively flexible, the distortion at the time of deformation can be eased by preparing one or more seal parts in film supporter material and parallel. Furthermore, the reinforcement of a flat film can be held by the seal section. ***** [the number of them / what] as long as the seal section is one or more places. What is necessary is just to determine the number of the parts of the seal section, and the magnitude of a seal with regards to the magnitude of a flat film, and the magnitude of a pressure.

[0019] Moreover, you may divide so that one film supporter material may have the plate-like film of two or more sheets in the longitudinal direction. the plate-like film of two or more sheets -- the shape of a strip of paper from film supporter material -- the direction of a right angle -- and it is desirable to be mutually prepared in the longitudinal direction at the serial. Especially the number of sheets of the plate-like film has about 2-10 desirable sheets. If number of sheets exceeds ten sheets, it is not economical, in order that the film surface product per sheet may decrease to one film supporter material and fabrication cost may cost dearly. The reinforcement of a flat film improves, and when a film surface swells with the pressure from the interior of a flat film, it is hard coming to damage by dividing the plate-like film into two or more sheets. Moreover, the flexibility of a flat film becomes good and the sludge in the liquid to filter etc. stops being able to adhere to a film surface easily. Moreover, the divided clearance becomes the passage of liquid and adhesion of sludge can be further prevented to the ability of an undiluted solution to go back and forth freely. The magnitude of the clearance between the divided adjacent plate-like film has 1mm - 50 desirablemm, and 2mm - its 20mm is still more desirable. If a clearance exceeds 50mm, a film surface product will become small, it is not economical, and on the other hand, by less than 1mm, when the plate-like film rocks, in order to rub, it becomes the cause of film breakage.

[0020] As this invention which can acquire the same effectiveness as the aforementioned division, a slit may be prepared in a film surface. As for a slit, it is effective to prepare in one side and the direction of a right angle of the plate-like film joined to film supporter material from the side of this opposite hand of one side. Although any number of number of slits is good, they are 1-9 pieces preferably. The width of face of a slit has 1mm - 50 desirablemm by the same reason as the plate-like film with which the above was divided, and 2mm - its 20mm is still more desirable.

[0021] Moreover, a flat film element is piled up so that it may have a fixed clearance in two or more sheet parallel, in this invention, it proposes further about the flat film module which gathered two or more flat film elements, and the module fixed only to the frame is also proposed. By fixing only to a frame, since the six cubical directions of all will be opened, receipts and payments of an undiluted

solution become good, and the aggregate of a flat film element can lessen adhesion of the sludge to a film surface. Spacing of the gap of a flat film element has 1mm - 20 desirablemm, and it is 3mm - 10mm preferably. When the sludge in an undiluted solution becomes easy to adhere to the film and it exceeds 20mm on the other hand in less than 1mm, a module becomes large too much and becomes less efficient.

[0022] The mounting arrangement to such a frame of a flat film element piles up the head connected with the ends of film supporter material with the head of a ***** element, gathers a flat film element, and puts a head on the crosspiece prepared in the frame. furthermore, the crosspiece from a head upside -- it can form by fixing a head to a frame with the presser-foot plate of a **. What kind of thing is sufficient as the construction material of a frame. Plastics may be used and stainless steel is sufficient. In the case of the latter, there is especially reinforcement and it is good. The flat film element used here is possible with any flat film elements. For example, what fixed the film to the filter plate may be used, and a flexible flat film element is sufficient. A flat film element with film supporter material etc. is effective in one side especially proposed by this invention.

[0023] Moreover, in this invention, the flat film module which contained the aggregate of two or more sheets of a flat film element in the case of a rectangular parallelepiped was proposed. This is the case of a rectangular parallelepiped and is the module of the structure which has the aperture which can take a flat film element in and out of a flank, and supported a part of configuration of a flat film element, for example, a head, by said flank and the reverse flank which counters. Receipts and payments of an element can be made easy by preparing an aperture in the flank of a flat film element, and the activity of receipts and payments can be simplified with supporting a part of element. Moreover, since area of a flank can be lessened by lessening the number of sheets of a flat film element, reinforcement becomes possible [reducing the load by the pressure concerning a part for the window part which is easy to become weak] comparatively.

[0024] The mounting arrangement to the case of a flat film element is the thing of the format supporting a part of flat film element. What kind of approach is sufficient as a concrete approach. For example, two crosspieces of fixed spacing can be prepared in an aperture inner surface and each opposite hand inner surface of an aperture up and down, and it can fix by inserting a part of flat film element (for example, edge of a head) between this crosspiece. Moreover, an undiluted solution can be introduced into a module together with a gas by attaching to the lower part of this flat film module the nozzle which can supply gaseous (for example, air), supplying a gas. Thereby, the cleaning effect of a film surface with a gas can be added.

[0025] Moreover, the flat film module of this invention also proposes the flat film module of the spiral mold with which it connected with the liquid collecting tube, and the plate-like film was wound around the end section of the plate-like strip-of-paper-like film about in the shape of a spiral, and it was inserted into cylinder tubing. Since the plate-like film is a strip of paper-like, an undiluted solution goes the interior of cylinder tubing back and forth in shaft orientations and the direction of a path freely through the gap of a strip-of-paper-like flat film, and sludge cannot adhere to a film surface easily. The number of sheets of a strip of paper has 2-100 desirable sheets, and they are 10-50 sheets preferably. This is because free traffic of an undiluted solution is blocked and sludge becomes easy to adhere to a film surface in less than two sheets. Moreover, if the number of sheets of a strip of paper exceeds 100 on the other hand, the cost on processing of a module attaches highly and is not economical. Moreover, what kind of construction material is sufficient as cylinder tubing used for this invention. For example, all plastics, such as polyolefine system resin, such as a polyvinyl chloride, polyethylene, and polypropylene, AS and ABS, acrylic resin, poly ape phone system resin, polyimide resin, and fluorine radical content resin, can be used. Moreover, metals, such as stainless steel, can be used. Since cylinder tubing can especially be used by this invention, it is effective to use lightweight and general-purpose plastic tubing.

[0026]

[Example] Hereafter, although an example explains this invention, this invention is not limited to these. Drawing 1 -6 show the flat film element of this invention, and drawing 7 -12 are drawing showing the

flat film module which used the flat film element. It explains per example 1. Drawing 1 -3 are drawing showing an example 1. It explains per configuration first. The textiles 11 of the shape of a mesh which 10 is a flat film element in drawing 1, and is the longwise permeate liquid passage material which is comparatively flexible as for the flat film element 10, and lets permeate liquid pass (it is the thickness of 2mm at a mesh-size 50) (henceforth a mesh), It has the plate-like film 13 of the quadrilateral which consisted of a flat film 12 prepared in the whole surface along both sides of a mesh 11, and was made to stick the flat film 12 of the mesh 11 of three sides of peripheries of these upper beds (drawing) and right-and-left ends, and a front flesh side, formed the seal section 14, and was made saccate. The flat film 12 used for example, the acrylonitrile polymer for the nonwoven fabric as a film formation raw material here, the filtration membrane was made to form by the phase converting method of a conventional method, and it is 2mm in thickness. Moreover, the seal section 14 is stuck to the plate-like film 13 using thermal melting arrival or adhesives. The plate-like film 13 is 600mm in width of face of 220mm, and height.

[0027] 15 is film supporter material. The film supporter material 15 It consists of a with the thickness of 4mm, and a height die length [about 240mm die length of 35mm] plate-like polyvinyl chloride, and is attached along with one-side 13a of the periphery which is not closed [of the plate-like film 13]. By soffit section of two sheets 12a of a flat film As shown in drawing 3, only height of 1.5cm covers the up (thickness [of 2.5mm], height of 15mm) both-sides front face of the film supporter material 15, it laps, joining is carried out to the film supporter material 15, and the plate-like film 13 is supported. Moreover, the passage 16 which is a **** path of 2 the cross section of 20mm which opens the film supporter material 15 for free passage in a mesh 11 inside is formed. 18 is a head, thickness is formed thickly (8mm) and the head 18 is formed in the ends of the film supporter material 15 in one with the film supporter material 15 from film supporter material. The nozzle (the outer diameter of 6mm, bore of 4mm) 19 of the shape of a pipe which carries out opening is formed in the upper part at both heads 18. A nozzle 19 is open for free passage through passage 16 to the film supporter material 15, and ejection makes permeate liquid possible. That is, the flat film element 10 consists of plate-like film 13, the film supporter material 15 and a head 18, and a nozzle 19. The permeate liquid which penetrated the flat film 12 from the exterior of an element at the time of filtration gathers for a mesh 11, descends and is collected outside from a nozzle 19 through the passage 16 in film supporter material.

[0028] Next, it explains per operation. Since the flat film element 10 of this invention is a square-like, supports this one-side 13a by the film supporter material 15 and forms the remainder from comparatively flexible mesh 11 and flat film 12, even if the flexible plate-like film 13 carries out a deformation splash by floating of an undiluted solution, and sludge cannot adhere to the plate-like film 13 easily and sludge adheres to the plate-like film 13 once at the time of filtration, it secedes from the plate-like film with deformation and a splash. Furthermore, since the flexible plate-like film 13 which can be manufactured cheaply, and the film supporter material 15 with reinforcement combine, it is cheap and can be made the structure where reinforcement can be held.

[0029] Next, it explains per [which is shown in drawing 4] example 2. Hereafter, a configuration is explained and an operation is explained below. in drawing 4, 20 is a flat film element and the flat film element 20 is shown in drawing 4 -- as -- four on the plate-like film 13 -- a line -- the seal section 22 is formed. a line -- one side and parallel of the plate-like film 13 whose seal section 22 formed the film supporter material 15 on the plate-like film 13 -- and -- from an upper bed -- caudad -- almost -- regular intervals (about 80mm) -- and the part of right and left of drawing which carried out the seal selectively except for about 50mm of a center section mostly, namely, was made to stick a flat film 12 and MESSHI 11, and carried out the seal is prepared. the time of filtration -- permeate liquid -- a line -- the seal section 22 -- meeting -- the center from right and left of the plate-like film 13 -- gathering -- after that -- descending -- the passage 16 and the nozzle 19 in the film supporter material 15 -- a passage -- the exterior -- collecting -- having . Since the seal section 22 is formed on the plate-like film 13 at four places, the flat film element 20 Also when it can improve and a pressure is added from the interior between flat films 12, even if it is prevented that between film swells greatly and deformation of the whole plate-like film 13 and a deflection tend to happen, the reinforcement of the flat film element 20

Deformation decreases for two or more seal sections, it prevents and distributes and a browning form can improve the reinforcement of the whole flat film element 20 substantially.

[0030] Next, it explains per [which is shown in drawing 5] example 3. Hereafter, a configuration is explained. In drawing 5, 25 is a flat film element and the flat film element 25 is the case where broke the three-sheet 10mm gap D in the longitudinal direction of film supporter material 15A, and longwise plate-like with width-of-face [of 100mm] and a height of 600mm film 13A is prepared in it in the shape of a strip of paper at a serial. Film supporter material 15A and with a thickness of 4mm partial 15a are provided in film supporter material 15A so that plate-like film of three sheets 13A may be inserted.

Next, an operation is explained. At the time of filtration, permeate liquid passes along each mesh 11 of each longwise plate-like film 13A, and is both collected outside from a nozzle 19 through the passage 16 in film supporter material 15A and a head 18. Since plate-like film of three sheets 13A ends spacing in one film supporter material 15A and is prepared in it at the serial, the area of the flat film element 25 per sheet decreases, and also when membranous reinforcement improves and it swells with the pressure from the interior of the film, it is hard coming to damage it. Moreover, the flexibility of the plate-like film becomes good, a deformation splash is improved, and the corruption in an undiluted solution etc. stops being able to adhere to a film surface easily. Moreover, Gap D can become the passage of liquid, an undiluted solution can go back and forth freely, and adhesion of sludge can be prevented further.

[0031] Next, it explains per [which is shown in drawing 6] example 4. Hereafter, a configuration is explained. In drawing 6, 30 is a flat film element, and the flat film element 30 forms the slit 33 of two 8mm width of face extended [to / from side 13b of an opposite hand, i.e. side 13b of the upper bed of drawing 6, / near the film supporter material 15] in a right angle, and seals the periphery of the plate-like film 13 with this side 13a at it at side 13a which has the film supporter material 15 on the plate-like film 13. Moreover, a nozzle is prepared only in the head by the side of an end at the film supporter material 15. Next, it explains per operation. At the time of filtration, permeate liquid passes along each mesh 11 between the slits 33 of the longwise plate-like film 13, and is both collected outside from a nozzle 19 through the passage 16 in the film supporter material 15 and the head 18 of the end. Since two slits are prepared in the plate-like film 13, when membranous reinforcement improves and it swells with the pressure from the interior of the film, it stops easily the flat film element 30 being divided by the slit 33, and each area of its during a partition decreasing, and being able to damage the plate-like film 13 like the flat film element 25 of an example 3. Moreover, the corruption in the undiluted solution which the flexibility of the plate-like film 13 becomes good, and is filtered etc. stops being able to adhere to a film surface easily. Moreover, the clearance between slits 33 becomes the passage of an undiluted solution, an undiluted solution goes back and forth freely, the plate-like film 13 rocks, and adhesion of sludge can be prevented.

[0032] Drawing 7 - drawing 11 show the example of the flat film module of this invention. Next, it explains per [which is shown in drawing 7] example 5. Hereafter, it explains per configuration. It is the flat film element 20 which showed the flat film module 35 to the example 2 (drawing 4) in drawing 7. the plate-like film 13 -- a line -- five flat film element 20A which formed the seal section 22 in seven places As it contacts mutually, a head 18 is accumulated on parallel and space (gap width of face of 4mm) is formed between the film supporter material 15 by the thick difference (4mm) with a head 18, the frame 37 made from stainless steel which has a foot 36 and the six directions of the shape of a rectangular parallelepiped opened is equipped. the crosspiece 38 which projected in two inner surfaces of frame 37A which the frame 37 bottom counters -- preparing -- a crosspiece 38 top -- the edge of a head 18 -- carrying -- a head 18 upside -- a crosspiece -- the presser-foot plate 39 of a ** is formed and a head 18 is fixed. Next, it explains per operation. Since six directions will have opened the flat film module 35 if it is put in into an undiluted solution, it flows in the six directions of a frame 37, especially between the film supporter material 15 flows through said space, and the receipts and payments of an undiluted solution of an undiluted solution are [the module] good. Since an undiluted solution flows making the plate-like film 13 of each other rock irregularly between the plate-like film 13 of five sheets, it can make small adhesion of corruption on the plate-like film 13. the permeate liquid which penetrated the plate-like film 13 -- a line -- the inside of the film between the seal sections 22 -- a passage -- the

plate-like film 13 -- it flows in the center section, it descends further, is collected in the passage 16. which is not illustrated, each nozzle 19, and the **** pipe which is not illustrated in the film supporter material 15, and is taken out outside. Furthermore, the effectiveness of deformation inhibition of the same plate-like film 13 as an example 2 or improvement in reinforcement can also be acquired.

[0033] Next, it explains per [which is shown in drawing 8] example 6. Hereafter, it explains per configuration. In the flat film element 30 which showed the flat film module 45 to the example 4 (drawing 6) in drawing 8 , it is the case where flat film element 30A which formed three slits 33 is used, and the five-sheet head 18 is contacted mutually, flat film element 30A is accumulated on parallel, it has a foot 46, and the frame 47 made from stainless steel which the six directions of the shape of a rectangular parallelepiped opened is equipped. In this case, it is in the condition which formed space (gap width of face of 4mm) between the film supporter material 15 by the thick difference (4mm) with the head 18 of the film supporter material 15, and six directions opened. moreover, the crosspiece 48 which projected in two inner surfaces of frame 47A which the frame 47 bottom counters -- preparing -- a crosspiece 48 top -- the edge of a head 18 -- carrying -- a head 18 upside -- a crosspiece -- the presser-foot plate 49 of a ** is formed and a head 18 is fixed. Next, it explains per operation. The flow of the undiluted solution which an undiluted solution flows the inside of a frame 47 in the six directions, flows through the space between the film supporter material 15, and passes along the gap of a slit 33 since six directions will have opened if it puts in into an undiluted solution arises, since the flat film module 45 has good receipts and payments of the undiluted solution of a between [the plate-like film 13], the plate-like film 13 can carry out a deformation splash, and it can make small adhesion of corruption on the plate-like film 13. The permeate liquid which penetrated the plate-like film 13 is collected in the passage 16 where it descends and the inside of the film between slits 33 is not illustrated in the film supporter material 15, each nozzle 19, and the **** pipe which is not illustrated, and is taken out outside. Furthermore, the effectiveness of deformation inhibition of the same plate-like film 13 as an example 4 or improvement in reinforcement can also be acquired.

[0034] Next, it explains per [which is shown in drawing 9 and 10] example 7. Hereafter, it explains per configuration. the flat film element 20 which showed the flat film module 50 to the example 2 (drawing 4) in drawing 9 -- setting -- a line -- four sheets and a head 18 are contacted mutually, flat film element 20B which formed the six seal sections 22 is accumulated on parallel, and it equips free [receipts and payments from the case (width of face of 60mm, depth of 250mm, height of 800mm) 53 which is the box made from plastics which has a foot 52]. Space (gap width of face of 4mm) is formed between the film supporter material 15 by the thick difference (4mm) with a head 18. The aperture 54 which can open and close a case 53 on one side face is formed, and receipts and payments of flat film element 20B are made free. Bolting of the aperture 54 is carried out by aperture closing motion plate 54A. As shown in drawing 10 , the projecting crosspieces 55A and 55B with a height [of two upper and lower sides] of 3mm are formed in each inside, and insertion immobilization of the head 18 which is a part of flat film element 20A is carried out at two side plates, the back side where the case 53 bottom counters, and an aperture side, 53A and 53B between the crosspieces of each two upper and lower sides of the crosspieces 55A and 55B by the side of this back and an aperture.

[0035] Moreover, the case 53 is established so that bottom plate 53C may have the soffit of flat film element 20B, and 50mm space and top-plate 53D may have the upper bed of flat film element 20B, and 50mm space. Moreover, the blowdown pipe 57 of 16mm of diameters for blowdown of concentration liquid on the top face of top-plate 53D is formed in the underside of bottom plate 53C of a case 53 in the delivery pipe 56 of 16mm of diameters for undiluted solution supply. 58 is output port of permeate liquid and output port 58 with a bore of 4mm is open for free passage to the **** pipe 59 which **** permeate liquid from four nozzles 19.

[0036] Next, it explains per operation. By receipts and payments of flat film element 20B being easy, and being able to do simply, since the aperture 54 which can take flat film element 20B in and out of the flank of a case 53 is formed and he is trying to support only some heads of flat film element 20B by the crosspiece 55, since there is little number of sheets of flat film element 20B as four sheets, area of an aperture 54 is made small, and the flat film module 50 of this invention is **. The load of the pressure

which joins the aperture 54 to which reinforcement tends [comparatively] to become weak can be made small. An undiluted solution passes along the space between bottom plate 53C of a case, and the soffit of flat film element 20B by the flat film module 50 of this invention from a delivery pipe 56. The whole surface on a bottom plate Breadth, Since it flows up through the space between the film supporter material 15 and concentration liquid is discharged from the blowdown pipe 57, an undiluted solution can flow a splash with a lifting on a lifting and the flexible plate-like film 13 in a vortex in the base and side face of a case, and can lessen adhesion of corruption on the plate-like film. Furthermore, the effectiveness of deformation inhibition of the same plate-like film 13 as an example 2 or improvement in reinforcement can also be acquired.

[0037] Next, it explains per [which is shown in drawing 11] example 8. Hereafter, it explains per a configuration and operation. The flat film module 60 enables it to connect the pneumatic supply pipe 62 which supplies the air which is a gas to the delivery pipe 56 of the undiluted solution of the flat film module 50 shown in drawing 9 in drawing 11 . Since air is supplied from a pneumatic supply pipe 62 together with the undiluted solution from a delivery pipe 56 to the flat film module 60, to it, an undiluted solution flows the front face of flat film element 20B with air bubbles, air stirring. While rocking the plate-like film 13 of flat film element 20B, it can prevent stirring the front face of the plate-like film also physically by crushing of an undiluted solution and the air bubbles of air etc., and corruption adhering to the plate-like film 13. Furthermore, the effectiveness of deformation inhibition of the same plate-like film 13 as an example 2 or improvement in reinforcement can also be acquired.

[0038] Next, it explains per [which is shown in drawing 12] example 9. Hereafter, it explains per configuration. In drawing 12 , the flat film module 70 rolls about the saccate stick-shape plate-like film 72 in the shape of a spiral centering on a liquid collecting tube 73, and contains it in the cylinder-like case 77. The strip-of-paper-like plate-like film 72 is flexible, and the flat film 12 of a quadrilateral is formed in the whole surface along both sides of the mesh (the same thing as an example 1) which is the permeate liquid passage material which lets permeate liquid pass. It divided in the shape of a strip of paper to 30 slits 33 extended to a lengthwise direction from the edge by the side of top chord 72a of this quadrilateral (1000mm long, 1000mm wide) to the suburbs of soffit section 72b by the side of the lower side which counters, and has connected with the longitudinal direction by soffit section 72b. Except lateral terminal section 72c, the plate-like film 72 closes 72d of all peripheries, and forms the bag-like object.

[0039] Moreover, in soffit section 72b, on the whole, the plate-like film 72 is open for free passage with an internal mesh, and forms the passage of permeate liquid. The liquid collecting tube 73 has ***** of a large number which are open for free passage in tubing for **** and which are not illustrated in the outside surface with 20mm of diameters. The mesh in lateral terminal section 72c is open for free passage to ***** of a liquid collecting tube 73, a flat film 12 surrounds and closes the surroundings of a liquid collecting tube 73, and the plate-like film 72 forms said bag-like object and the one-bag-like object. And the plate-like film 72 is made as [contain / a cylindrical shape / a corrugated spacer with a width of face of 4mm is rolled in piles by the outside surface of the soffit section 72b in the shape of a spiral around a liquid collecting tube 73, and / in nothing and the cylindrical case 77 with an outer diameter of 130mm]. A case 77 has the disc-like bottom plate 78 in the soffit section, and has the disc-like top plate 79 in the upper bed section. And while support closure of the upper bed of a liquid collecting tube 73 is carried out at the core of a top plate 79, it is made as [carry out / outside / penetrate the core of a bottom plate 78 and / opening]. Moreover, the feed hopper 81 which is an inlet port for supply of the undiluted solution which is a processed liquid is formed in a bottom plate 78, and the exhaust port 82 which is an outlet which discharges concentration liquid is formed in the top plate 79. Between a bottom plate 78 and a top plate 79, and a case 77 and between liquid collecting tubes 73, the O ring which consists of nitrile rubber for seals (NBR rubber) which is not illustrated, respectively is prepared, and it is made as [seal].

[0040] Next, it explains per operation. An undiluted solution is introduced in a case 77 from a feed hopper 81, passes along the gap of the corrugated spacer 75, and flows the outside of the flat film 12 of the shape of a strip of paper of the plate-like film 72 to shaft orientations, and the flat film module 70 of

this invention flows in the direction of a path through between slits, and is discharged outside from the upside exhaust port 82. The permeate liquid which penetrated the flat film 12 passes along an internal mesh, after it descends to soffit section 72b, it flows in the direction of a core in the shape of a spiral, it is brought together in a liquid collecting tube 73, and is taken out from a lower part outside. In the flat film module 70, the undiluted solution with which it passed along the gap of the corrugated spacer 75 since the plate-like film 72 was formed in the shape of a strip of paper flows freely in the direction of a path through the gap of upper shaft orientations or a slit 33 along with the flat film 12 of the plate-like film 72. Moreover, since the plate-like film 72 has become [flexibility] still better by the shape of a strip of paper, each plate-like film 72 rocks and there is little adhesion of corruption on the plate-like film. Moreover, since it is divided by the slit 33, the plate-like film 72 has a small area of strip-of-paper-like each part, deformation and distortion also become small, and is large, and can make dependability high. [of the reinforcement of the plate-like film 72]

[0041]

[Effect of the Invention] As mentioned above, by the plate-like film rocking, sludge being unable to adhere easily, and the flexible plate-like film rocking, and the impossible force not being added, being hard to damage by the flow of an undiluted solution, and preparing the seal section and a slit, since the plate-like film is flexible according to the flat film element of this invention as explained, while preventing deformation and making reinforcement increase, it can be made rockable, and it can consider as a reliable element. Moreover, since it does not have the complicated structure of preventing breakage, it can manufacture cheaply and a merit is economically high. Furthermore, since penetrable high ability is maintainable while having the effective structure where the sludge on which the pressure was put from the interior of the plate-like film of a flat film element and which adhered to the film surface can be taken, the economical flat film element which is easy to use it can be obtained.

[0042] Moreover, according to the flat film module of this invention, the engine performance of a flat film element can be pulled out effectively, and since it is simple structure, cost can be made cheap. Moreover, since attachment and detachment of a flat film element are easy, when using many modules, there is little time amount of attachment and detachment, and it ends and is economical. Moreover, there is also little adhesion of corruption, in the module of a spiral mold, since reinforcement can also do dependability highly in size and cylindrical tubing is used further, lightweight and general-purpose tubing can be used, it is cheap and handling can consider as an easy module.

[Translation done.]